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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/614,310	07/07/2003	Jerry R. Kukulka	PD-01-946/11827 (21797-00	8247

7590 12/24/2008

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EXAMINER	
TRINH, THANH TRUC	
ART UNIT	PAPER NUMBER
1795	
MAIL DATE	DELIVERY MODE
12/24/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/614,310	KUKULKA ET AL.	
	Examiner	Art Unit	
	THANH-TRUC TRINH	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 September 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Remark

1. Claims 1-20 are pending in the application.

2. All previous rejections are maintained.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 3-6, 8-10, 12 and 14-19 are rejected under 35 U.S.C. 102(b) as being anticipated by Kressel et al (US patent 4070206).

Regarding claims 1 and 3, as seen in Figures 1, 3, 4-7, Kressel et al discloses a solar cell structure (10) comprising semiconductor layers (18, 22, 20 in Figures 1 and 3; 118, 120 and 122 in Figures 4-7) in facing contact with each other to form P-N junctions (24 and 26 in Figures 1 and 3; 124 and 126 in Figures 4-7- See col. 2 lines 33-49); a shunt (pocket regions 28 or 30 in Figures 1 and 3; 128 or 130 in Figures 4-7) comprises a channel of an altered material, wherein the altered material is highly doped material (see col. 3 lines 2-7) extending between and at least through two layers of semiconductor layers, and comprise a channel of altered material. (See Fig. 1, 3, and col. 3 lines 2-7). Because the shunt (or pocket regions 28 or 30) comprises altered material of highly doped material of either N or P conductivity and extending through P-

N junction(s), therefore it is the Examiner's position that the shunt (or pocket regions 28 or 30) has a asymmetric current-voltage characteristic of passing a small current when voltage-bias in a forward direction parallel to the channel, and passing a large current when voltage-biased in a reverse direction parallel to the channel and opposite to the forward direction, particularly in view of the fact that the pocket regions of Kressel having doped altered material similar to the approach of how Applicant achieves a shunt with claimed characteristics. (See paragraph 008 of Applicant's specification)

Regarding claim 4-5, Kressel et al disclose that the solar cell comprises more than two semiconductor layers, wherein the shunt (28 in Figures 1 and 3, 128 in Figure 7) extends between and at least partially through two of the semiconductor layers, and shunt (30 in Figures 1 and 3, 130 in Figures 4-7) extends between and at least partially through three of the semiconductor layers. (See Figures 1, 3 and 7).

Regarding claim 6, Kressel et al disclose that the solar cell comprises plurality of channels (or pocket regions 28 and 30) spaced apart from each other over a front-side surface of the solar cell. (See Fig. 1 and 3).

Regarding claims 8-10, as seen in Figures 1, 3 and 4-7, Kressel et al. teaches a method for fabricating a solar cell structure comprising the steps of depositing a solar cell comprising two or more semiconductor layers (18, 22 and 20 in Figures 1 and 3; 118, 122 and 120 in Figures 4-7) in facing contact with each other, wherein the semiconductor layers comprise a semiconductor junction (24 or 26 in Figures 1 and 3, 124 or 126 in Figures 4-7) producing a voltage between the two semiconductor layers when illuminated (See col. 4 lines 15-50 and Abstract), forming a shunt (or pocket

regions 28 or 30) comprising a channel of an altered material extending between at least partially through at least two semiconductor layers (such as pocket region 28 in Figures 1 and 3, and 130 in Figure 7), or at least three of the semiconductor layers (such as pocket region 30 – See col. 4 line 51 to col. 5 line 13). Because the shunt (or pocket regions 28 or 30) comprises altered material of highly doped material of either N or P conductivity and extending through P-N junction(s), therefore it is the Examiner's position that the shunt (or pocket regions 28 or 30) has a asymmetric current-voltage characteristic of passing a small current when voltage-bias in a forward direction parallel to the channel, and passing a large current when voltage-biased in a reverse direction parallel to the channel and opposite to the forward direction, particularly in view of the fact that the pocket regions of Kressel having doped altered material similar to the approach of how Applicant achieves a shunt with claimed characteristics. (See paragraph 008 of Applicant's specification)

Regarding claim 12, Kressel et al. teaches the step of forming a shunt includes a step of doping the channel. (See col. 4 line 51 to col. 5 line 13)

Regarding claims 14-15, as seen in Figures 1, 3 and 7, Kressel et al teaches forming a plurality of channels (or pocket regions 28 and 30 in Figures 1 and 3, 128 and 130 in Figure 7) spaced apart from each other over a front side surface of the solar cell. Kressel et al. also teaches a photovoltaic device (or solar cell) is used to generate carriers by absorbing solar radiation (See Summary of Kressel et al.). Therefore it is the Examiner's position that Kressel et al. teaches a step pf placing the solar cell structure into service.

Regarding claim 16, as seen in Figure 6, Kressel et al. teaches the solar cell further comprises a front side metal grid (136) and a back side metallization (154).

Regarding claim 17, as seen in Figure 6, Kressel et al. disclose a solar structure comprising a solar cell 110 having two semiconductor layers 118 and 122 to form a pn junction 124, or two layers semiconductor layers 122 and 120 to form a pn junction 126, wherein the pn junction produces a voltage between the two semiconductor layers when illuminated; a front side metal grid 136 (See col. 5 lines 39-60); a back side metallization 154 (See col. 6 lines 23-25); a shunt (or pocket regions 128 and 130) comprising a channel of a doped altered material (heavily doped semiconductor, See col. 3 lines 2-7) extending between and at least partially through the two semiconductors. Pocket region 128 extends between and at least partially through the two semiconductors 118 and 122, and pocket region 130 extends between and at least partially through the two semiconductors 122 and 122. Because the shunt (or pocket regions 28 or 30) comprises altered material of highly doped material of either N or P conductivity and extending through P-N junction(s), therefore it is the Examiner's position that the shunt (or pocket regions 28 or 30) has a asymmetric current-voltage characteristic of passing a small current when voltage-bias in a forward direction parallel to the channel, and passing a large current when voltage-biased in a reverse direction parallel to the channel and opposite to the forward direction.

Regarding claim 18, Kressel et al. disclose the solar cell comprising three semiconductor layers 118, 120 and 122 (more than two semiconductor layers), wherein

the shunt (or pocket regions 20 and 30) extend between and at least partially through at least two of the semiconductors layers. (See Figure 6)

Regarding claim 19, Kressel et al. disclose the shunt comprises a plurality of channels (pocket regions 128 and 130) spaced apart from each other over a front-side surface of the solar cell. (See Figure 6).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* **v.** *John Deere Co.,* 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. Claims 2, 11 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kressel et al in view of Gibbons (US Patent 3718502)

Kressel et al disclose a solar cell structure and a method of fabrication as applied to claims 1, 3-6, 8-10, 12 and 14-19, wherein the channel (or pocket region 28 or 30) is

highly doped with N or P conductivity by placing the semiconductor body into a diffusion furnace (See col. 4 lines 51 to col. 5 line 13).

Kressel et al do not teach the altered material is a proton-irradiated altered material, nor do they specifically teach the steps of directing a proton beam into the semiconductor layers, doping the channel by ion implantation and annealing the channel.

With respect to claim 2, Gibbons teaches irradiating semiconductor layers with proton to enhance the diffusion of P-type or N-type to a certain depth. (See col. 3 line 41 to col. 6 line 29). In such combination of Kressel et al. and Gibbons, it is the Examiner's position that the altered material (P- or N-type material) is proton-irradiated altered material.

With respect to claim 11, Gibbons teaches directing a proton beam into the semiconductor layers to enhance the diffusion of atoms into the semiconductor layers. (See col. 3 line 41 to col. 6 line 29)

With respect to claim 13, Gibbons teaches doping a semiconductor layer by ion implantation and annealing the material. (See col. 3 lines 41-67, col. 9 lines 1-56)

It would have been obvious to one having ordinary skill in the art at the time of the invention was made to modify the structure of Kressel et al by having the altered material is a proton-irradiated altered material as taught by Gibbons because Gibbons teaches the proton irradiation would enhance the diffusion of dopant (P- or N-type; See Abstract of Gibbons and col. 3 line 41 to col. 4 line 66), and modify the method of Kressel et al. by directing a proton beam into the semiconductor or doping the channel

by ion implantation and annealing the channel as taught Gibbons, because Gibbons teaches the proton irradiation would enhance the diffusion of dopant (P- or N-type; See Abstract and col. 3 line 41 to col. 6 line 66) and the ion implantation followed by annealing the semiconductor material is one of several well known techniques in doping semiconductor material (See col. 3 lines 41-66 and col. 9 lines 1-56)

8. Claims 7 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kressel et al in view of Mann et al. (US Patent 3340096)

Regarding claims 7 and 20, Kressel et al teaches a solar cell structure as applied to claims 1, 3-6, 8-10, 12 and 14-19.

Kressel et al does not teach interconnecting solar cells.

Mann et al. teaches interconnecting solar cells in series and parallel (See col. 1 lines 14-19).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the structure of Kressel et al by electrically interconnecting plurality of solar cells of Kressel as taught by Mann et al., because Mann et al. teaches that the required voltage and current would be achieved by interconnecting the cells in series and parallel. (See col. 1 lines 14-19)

Response to Arguments

Applicant's arguments filed 9/10/2008 have been fully considered but they are not persuasive.

Applicant argues that Kressel does not teach a shunt having an asymmetric current-voltage characteristic of passing a small current when voltage-biased in a forward direction parallel to the channel, and passing a large current when voltage-biased in a reverse direction parallel to the channel and opposite to the forward direction. However, the Examiner respectfully disagrees. As seen in Figures 1, 3, 4-7, Kressel et al discloses a solar cell structure (10) comprising semiconductor layers (18, 22, 20 in Figures 1 and 3; 118, 120 and 122 in Figures 4-7) in facing contact with each other to form P-N junctions (24 and 26 in Figures 1 and 3; 124 and 126 in Figures 4-7- See col. 2 lines 33-49); a shunt (pocket regions 28 or 30 in Figures 1 and 3; 128 or 130 in Figures 4-7) comprises a channel of an altered material, wherein the altered material is highly doped material (see col. 3 lines 2-7) extending between and at least through two layers of semiconductor layers, and comprise a channel of altered material. (See Fig. 1, 3, and col. 3 lines 2-7). Because the shunt (or pocket regions 28 or 30) comprises altered material of highly doped material of either N or P conductivity and extending through P-N junction(s), therefore it is the Examiner's position that the shunt (or pocket regions 28 or 30) has an asymmetric current-voltage characteristic of passing a small current when voltage-bias in a forward direction parallel to the channel, and passing a large current when voltage-biased in a reverse direction parallel to the channel and opposite to the forward direction, particularly in view of the fact that the pocket regions of Kressel having doped altered material similar to the approach of how Applicant achieves a shunt with claimed characteristics. (See paragraph 008 of Applicant's specification).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to THANH-TRUC TRINH whose telephone number is (571)272-6594. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Nam X Nguyen/
Supervisory Patent Examiner, Art Unit 1753

TT
12/18/2008